

# Needham Environmental Inc.

Robert N. Needham, PWS  
9100 Charlestowne Rd. SE  
Winnabow, NC 28479  
Office/Fax (910)371-6082  
needhambud@cc.rr.com

Tom Gulley, NCLSS#1256  
P.O. Box 960  
Wilmington, NC 28402  
Office/Fax (910)795-0319  
tgulley@gmail.com

---

July 19, 2015

Sammy Varnam  
Sunset Beach West, LLC  
1574 Monster Buck Estates NW  
Supply, NC 28462

RE: Private Water Supply Well Report for the proposed Sunset Beach West Subdivision,  
Sunset Beach, North Carolina.

Dear Mr. Varnam:

Needham Environmental, Inc. was asked to investigate the potential for placing individual, private water supply wells on the lots within the proposed Sunset Beach West project. This site is located at the western end of West Main Street and is Brunswick County Parcel ID# 263AH01502. Mr. Lenny Dorn, N.C. certified well driller #2942, was also consulted with and assisted with this investigation. Mr. Dorn has over 35 years of experience drilling and installing wells along all the Brunswick County beaches, including Sunset Beach. He installed a well at 1405 West Main Street, which directly abuts this proposed project to the east.

Historically, the barrier islands along the Brunswick county beaches, including Sunset Beach, were developed with private, on-site water supply wells and private, on-site septic systems. These wells were installed shallow, typically less than 20' deep, or within the freshwater lens that floats on top of the denser salt water. The freshwater lens is naturally recharged by rainfall infiltrating the sandy soil of the barrier island. This method has worked for decades and the only reason it is not as prevalent anymore is due to the availability of county water and sewer, as well as much greater lot densities on some beaches. Many of the original barrier island developments that utilized these shallow wells were only 50'x100' in size which is 1/4th the size of the smallest lots proposed at Sunset Beach West. This is a proven method to supply suitable drinking water and it is a recognized as a permissible option in 15A NCAC 02C .0116 of the North Carolina Administrative Code, which is shown below:

## **15A NCAC 02C .0116 DESIGNATED AREAS: WATER SUPPLY WELLS CASED TO LESS THAN 20 FEET**

(a) In some areas the best or only source of potable water supply exists between 10 and 20 feet below the surface of the land. In consideration of this, water supply wells may be cased to a depth less than twenty feet in the following areas:

(1) in Currituck County in an area between the sound and a line beginning at the end of SR 1130 near Currituck Sound, thence north to the end of SR 1133, thence north to the end

of NC 136 at the intersection with the sound;

(2) on the Outer Banks from the northern corporate limit of Nags Head, south to Ocracoke Inlet;

(3) all areas lying between the Intracoastal Waterway and the ocean from New River Inlet south to New Topsail Inlet; and

(4) all areas lying between the Intracoastal Waterway and the ocean from the Cape Fear River south to the South Carolina line.

(b) The Director may designate additional areas of the state where water supply wells may be cased to a depth less than 20 feet. To designate such areas, the Director shall find:

(1) that the only or best source of drinking water in the area exists between a depth of 10 and 20 feet below the surface of the land; and

(2) at utilization of this source of water in the area is in the best interest of the public.

© In all other areas, the source of water shall be at least 20 feet below land surface, except when adequate quantities of potable water cannot be obtained below a depth of 20 feet, the source of water may be obtained from unconsolidated rock formations at depths less than 20 feet provided that:

(1) sufficient water of acceptable quality for the intended use can be shown, to the satisfaction of the Department that it is not available to a minimum depth of 50 feet;

(2) the proposed source of water is the maximum feasible depth above 20 feet, but in no case less than 10 feet; and

(3) the regional office of the Department is notified prior to the construction of a well obtaining water from a depth between 10 and 20 feet below land surface.

History Note: Authority G.S. 87-87;

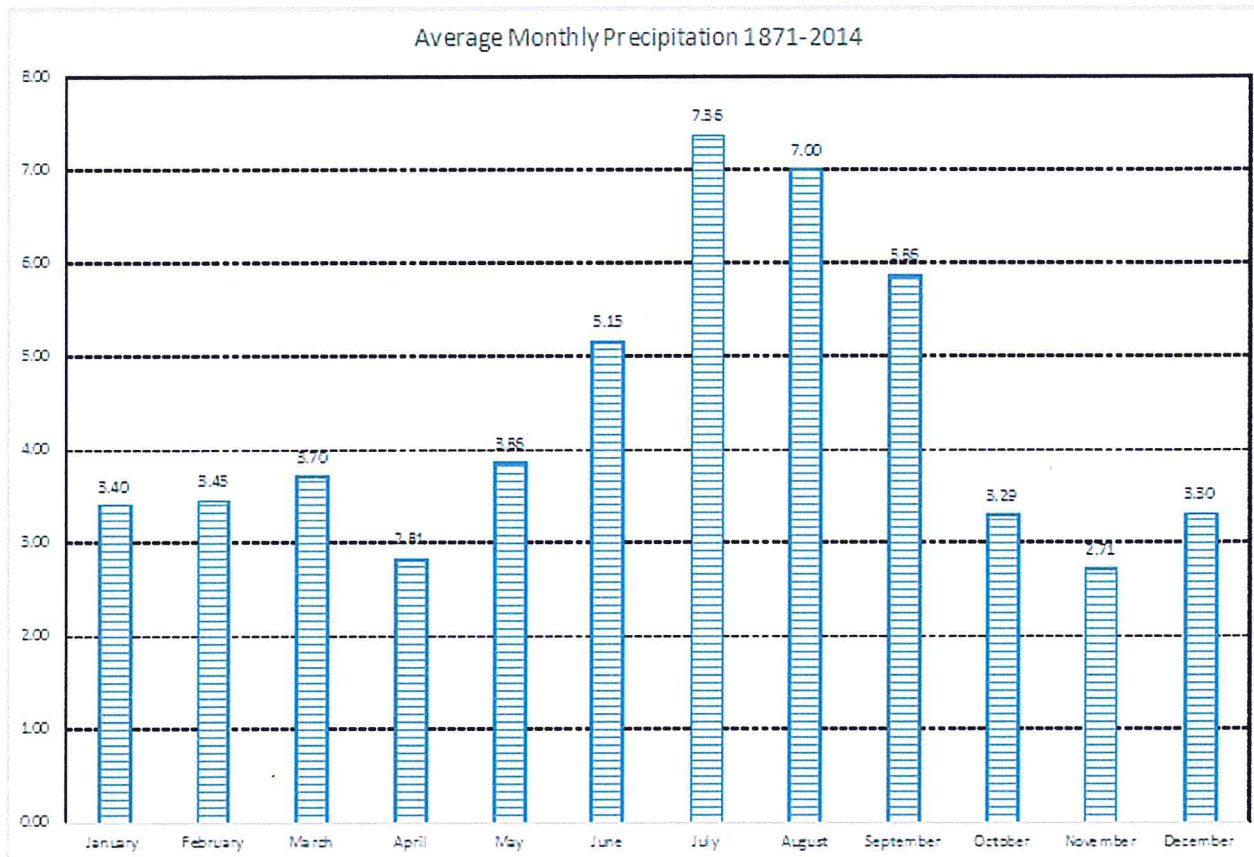
Eff. April 20, 1978; Amended Eff. September 1, 2009, December 1, 1992; July 1, 1988; September 1, 1984.

This freshwater lens is a shallow, thin layer that averages approximately 15' in depth. When water is rapidly removed from this layer by a pump there is potential for a cone of depression to form large enough to allow for salt water intrusion. Installing a horizontal well, instead of a vertical well, within the freshwater lens will lessen the cone of depression since the drawdown occurs over a larger and shallower area and not a single point. Horizontal wells are not required, but their use will lessen the possibility of salt water intrusion. Additionally, placing smaller, individual, on-site water supply wells on each lot, which do not operate above 30 gallons/minute, will cause multiple small cones of depression to form as compared to a single, large cone of depression from a commercial well that operates at over 300 gallons/minute. The use of low flow fixtures, which are commonplace in new homes, will reduce the daily water demand or use for each home and reduce the freshwater removed at each well site, reducing the potential of a cone of depression.

Salt water intrusion could be accelerated by periods of reduced precipitation. Due to the location and nature of this project, a large percentage of these homes will be vacation homes and second homes that will be occupied more frequently in the summer months and occupied less frequently in the winter months. Based on this premise greater water usage will occur in the summer months, which will cause more water to be pumped from or removed from the freshwater lens. Below is a



bar graph showing the average monthly precipitation for Wilmington, NC, which has similar seasonal rainfall patterns as Sunset Beach. The monthly rainfall totals are shown in inches and the data set to create this graph is from 1871 through 2014.



Notice the four months with the highest average rainfall totals are June, July, August, and September or the summer and vacation months. The periods of higher water usage or higher water demand will coincide with the months and season that historically has higher rainfall totals, which will help to keep the freshwater lens recharged.

The Wilmington National Weather Service Office precipitation data was utilized for the graph above, as it was the longest period of recorded data in the region, (more than 130 years). When local news reports “normal” monthly or annual precipitation, they are referring to a recent 30 year average supplied by the Weather Service Office (WSO). These are updated every decade on the years ending in zero. For the Sunset Beach analysis, Needham Environmental have chosen to review the long term precipitation data from 1871. The monthly, summer and annual precipitation totals, are more conservative than the recent 30 year “normal”. We believe utilizing the long term conservative precipitation values is a better approach, then a wetter recent 30 year period. The table below shows *long term* versus *recent 30 year “normal”* values for the four months of concern, with respective summer and annual totals.

Period	June avg.	July avg.	August avg.	September avg.	summer avg.	Annual avg.
1871-2010	5.06	7.62	7.75	7.54	24.82	51.89
1981-2010	5.12	7.5	6.77	5.43	27.96	57.26

The soils on the island also play a role in recharging the freshwater lens. The soils on the majority of the island and specifically on this portion of the island are in the Newhan Soil Series. These soils are deep fine to medium grained sands and have very rapid infiltration rates, usually in excess of 20 inches/hour. The high infiltration rate results in no runoff and all rainfall will migrate through the soil profile and recharge the freshwater lens. In addition to the constant recharging from rainfall, all of the wastewater from each home will be treated by an on-site septic system allowing for all of the water used in the home to be placed back into the freshwater lens and creating a closed loop. The water pumped from the freshwater lens will be treated by the septic system, migrate through the soil profile, return to the freshwater lens. If county sewer were available and the wastewater from each home was taken to an offsite treatment plant and discharged, there would be a net loss or permanent removal of water from the freshwater lens. Obviously, the required setbacks from the wastewater system and a well should be maintained, which is 100' but can be reduced to 50' as stated in the 15A NCAC 18A .1950 of the North Carolina Administrative Code. So the rainfall, high infiltration rates of the soils present, along with the individual, on-site septic systems, will result in the natural recharge of the of the freshwater lens.

In order to determine if the shallow, freshwater lens was present within the project area, three shallow well casings were installed within the typical depths of the freshwater lens and Mr. Dorns collected water samples at each location. The approximate location of each well is shown on the attached "Preliminary Plat for Sunset Beach West" by Cape Fear Engineering. The samples were then taken to the Envirochem Lab in Wilmington for analysis. Multiple tests were performed on each sample and the Environmental Protection Agency (EPA) test methods were used by the lab, but the primary purpose was to test for Chloride levels, which is an indicator of salt water. The results of the water analysis for each well location are also attached, along with a Maximum Contaminant Levels (MCLs) for Drinking Water Chart prepared by the Craven County Health Department, which uses the same State and Federal standards as the Brunswick County Health Department. These standards or limits are set by the EPA under the Safe Drinking Water Act. and are also listed in 40 CFR 141.23.

The samples did not exceed the MCLs for any given chemical test. One item worth noting is that the samples were tested for total coliform and if present tested for E. Coli as required in the sampling procedures and analysis outlined in 15A NCAC 18A .3800 of the North Carolina Administrative Code (Private Well Water Sampling). In both instances where total coliform was present, E. Coli was not. Regardless, the most import result is that the Chloride levels ranged from 9 mg/L to 12 mg/L, which is well below the maximum contaminant level of 250 mg/L required by the EPA. So the freshwater lens does exist at the depths sampled within the project area. This lens will also be present at all other locations within the project area.

Based on the historical use of the freshwater lens on North Carolina's barrier islands and the test



results indicating that the freshwater lens is present, one well installed on each lot should supply sufficient fresh drinking water to support the eight-bedroom homes proposed on each lot. It is also Mr. Dorns professional opinion that one 4 inch well per lot will provide all the necessary water for an eight bedroom house.

If your have any questions or concerns regarding this report, please contact me at (910)795-0319, (910)297-1282, or by e-mail at [tgulley@gmail.com](mailto:tgulley@gmail.com).

Sincerely,

A handwritten signature in black ink that reads "James T. Gulley, Jr." with a stylized, cursive script.

J. Tom Gulley, Jr.  
North Carolina Soil Scientist License# 1256

